214. **A NOVEL TANDEM HOMOJUNCTION SOLAR CELL: AN ADVANCED TECHNOLOGY FOR HIGH EFFICIENCY PHOTOVOLTAICS**
$322,000
DOE Contact: Walter M. Polansky, (301) 903-4\5995
Colorado State University Contact:
Henryk Temkin, (303) 491-6018

The semiconductor, ZnSnP(2), meets many criteria for large-scale photovoltaic applications. It is isoelectronic with the III-V alloy InGaP(2), but has the advantage, for photovoltaic applications, of not containing expensive and rare group III elements. In addition, this material does not contain toxic heavy metals such as are found in CdTe and CuInSe(2)/CdS thin film solar cells. The absorption coefficient for this material is also very high. The bandgap of ZnSnP(2) has the additional interesting and useful property of ranging from 1.24 to 1.66 eV, depending on the preparation conditions. There is no *a priori* reason that the electronic properties of these materials cannot be made as good as III-V materials, since very high mobilities were only achieved in III-V's after the development of modern epitaxial growth techniques. State-of-the-art metal-organic molecular beam epitaxy (MOMBE) will be used to grow epitaxial layers of ZnSnP(2) on lattice matched GaAs substrates. When the conditions can be established for preparing a material of a given bandgap, a "tandem homojunction" solar cell will be fabricated by variation of growth conditions in the MOMBE chamber in the appropriate way. This device should show significant efficiency advances over a single material device or tandem heterojunction devices where lattice mismatch produces recombination promoting interface states.

Keywords: Tandem-Homojunction Solar Cell, Photovoltaics, Molecular Beam Epitaxy

OFFICE OF FUSION ENERGY

The mission of the Office of Fusion Energy (OFE) is to develop fusion as an environmentally attractive, commercially viable, and sustainable energy source for the Nation and the world. This mission will be accomplished by parallel activities to develop the science and technology base for fusion, the conduct of large-scale experiments to explore the physics and demonstrate the components of fusion technologies, and the construction and operation of fusion power plants that will culminate in a demonstration power plant.

A significant component of the fusion energy program is the development and validation of the materials required for the fusion systems. Materials must be developed that will meet the unique requirements of fusion, as well as the standard requirements of a high efficiency, high reliability power generating system. The unique requirements of fusion are the result of the intense neutron environment, dominated by the 14 MeV neutrons characteristic of the deuterium-tritium fusion reaction. For performance, the materials must have slow and predictable degradation of properties in this neutron environment. For safety and environmental considerations, materials must be selected with activation products that neither decay too rapidly (affecting such safety factors as system decay heat) nor too slowly (affecting the waste management concerns for end-of-life system components). Materials that meet these requirements are referred to as "Low Activation Materials." Programs to develop the materials for plasma-facing components, for diagnostic and control systems, for structures in the high neutron flux regions, for the production of tritium in the blanket, and for the superconducting magnets required for confinement are sponsored by OFE.

The fusion program in the United States is conducted with a high degree of international cooperation. Of particular importance is the International Thermonuclear Experimental Reactor (ITER) engineering design activity, conducted in partnership with the European Union, Japan, and the Russian Federation. Approximately half of the materials work sponsored by OFE is in support of the ITER collaboration.

MATERIALS PROPERTIES, BEHAVIOR, CHARACTERIZATION OR TESTING

215. **STRUCTURAL MATERIALS DEVELOPMENT**
$1,552,000
DOE Contact: F. W. Wiffen (301) 903-4963
ANL Contact: D. L. Smith (708) 252-4837

This program is directed at the development of advanced, low activation structural materials for application in fusion power system first wall and blankets. Emphasis at ANL is on the development of vanadium-base alloys and on chemical corrosion/compatibility of the structural materials with other system materials. The vanadium alloy development is focused on the V-Cr-Ti system, with the goals of identifying promising candidate compositions, determining the properties of candidate alloys, and evaluating the response to irradiation conditions that simulate anticipated fusion system operation. The compatibility studies include vanadium and other candidate structural materials, and focus on the effects of exposure to projected coolants, especially liquid lithium.

Keywords: Vanadium, Compatibility, Lithium, Irradiation Effects, Alloy Development

216. **REPAIR WELDING OF FUSION REACTOR COMPONENTS**
$100,000
DOE Contact: F. W. Wiffen, (301) 903-4963
Auburn University Contact: B. A. Chin, (334) 844-3322

Repair welding of metal components that have been in service under neutron irradiation is limited by the tendency of the material to crack during welding. This program is identifying the mechanisms of the weld cracking and the association with transmutation-produced helium. Experiments on the effects of stress state on the growth of helium bubbles is expected to lead to methods to mitigate the weld cracking problem in irradiated steels.

Keywords: Steels, Welding, Irradiation Effects

217. **INSULATING CERAMICS FOR FUSION**
$435,000
DOE Contact: F. W. Wiffen, (301) 903-4963
LANL Contact: E. H. Farnum, (505) 665-5223

The goals of this project are to determine the changes in electrical, optical and structural properties of ceramic insulators in predicted fusion service, especially the effects of neutron irradiation. An understanding of the effects of radiation and of the controlling mechanisms are used to select or develop materials capable of extended life for use in fusion systems.

Keywords: Ceramics, Electrical Properties, Irradiation Effects

218. **MODELING IRRADIATION EFFECTS IN SOLIDS**
$100,000
DOE Contact: F. W. Wiffen, (301) 903-4963
LLNL Contact: T. Diaz de la Rubia, (510) 422-6714

Large scale computer simulation and experimental data on irradiation effects are combined to extend the understanding of the primary damage processes in solids. Special attention is given to the energy range appropriate for the 14 MeV neutrons produced in D-T fusion, and to the materials of interest for fusion systems.

Keywords: Modeling, Irradiation Effects

219. **FUSION SYSTEMS MATERIALS**
$3,815,000
DOE Contact: F. W. Wiffen, (301) 903-4963
ORNL Contacts: E. E. Bloom, (423) 574-5053 and A. F. Rowcliffe, (423) 574-5057

This program is directed at the development and qualification of structural materials and insulating ceramics for use in components of fusion power systems exposed to the intense neutron flux. Candidate low activation structural material systems include ferritic/martensitic steels, vanadium alloys and SiC/SiC composites. Investigations focus on the most critical questions or limiting properties in each of these systems: ferritic/martensitic steels - DBTT transition shifts and fracture toughness, vanadium alloys - welding processes, effects of irradiation on fracture toughness, and compatibility in proposed coolant systems, SiC/SiC composites - definition of the effects of irradiation on properties and structure. The insulating ceramic activity is initially developing an understanding of irradiation effects in alumina, spinel, and other materials. The greatest concern is to establish the permanent and transient changes in electrical properties, requiring measurement while the specimen is under irradiation. Work on these material classes involves irradiation in fission reactors, including HFIR, HFBR, and other test reactors, as partial simulation of the fusion environment.

Keywords: Ceramics, Steels, Vanadium, Silicon Carbide, Composites, Irradiation Effects, Electrical Properties

220. **STRUCTURAL MATERIALS FOR FUSION SYSTEMS**
$1,613,000
DOE Contact: F. W. Wiffen, (301) 903-4963
PNNL Contact: R. H. Jones, (509) 376-4276

The goal of this program is to develop an understanding of radiation effects that provides a basis for development of irradiation insensitive materials. The objective is low activation materials for use as structures in divertor, first wall, and blanket components of fusion systems. Irradiation in fission reactors is used to simulate fusion conditions, with measurement of physical and mechanical properties used to track irradiation effects. A modeling activity complements the experimental measurements. The ultimate goal is optimized ferritic steels, vanadium alloys, and SiC/SiC composite materials for fusion power plant use.

Keywords: Steels, Vanadium, Silicon Carbide, Composites, Irradiation Effects, Modeling

221. **DEVELOPMENT OF RADIATION-HARDENED CERAMIC COMPOSITES FOR FUSION APPLICATIONS**
$60,000
DOE Contact: F. W. Wiffen, (301) 903-4963
RPI Contact: D. Steiner, (518) 276-4016

This research is directed at furthering the understanding of the effects of irradiation on the SiC/SiC composite system, as the basis for developing superior composite materials for fusion structural applications. The focus of the work is on the evaluation of improved fibers and alternative interface layer materials.

Keywords: Silicon Carbide, Composites

222. **RADIATION EFFECTS AND MICROMECHANICS OF SiC/SiC COMPOSITES**
$115,000
DOE Contact: F. W. Wiffen, (301) 903-4963
UCLA Contact: N. M. Ghoniem, (310) 825-4866

The goal of this program is to develop an understanding of the basic processes of neutron damage production, microstructural evolution, chemical compatibility, and micromechanics of fracture in SiC/SiC composite materials. This basic knowledge of materials behavior is used to model the effects of irradiation and the service performance of SiC/SiC components in fusion power systems. The critical goal is helping to evaluate the feasibility of using SiC/SiC in this application.

Keywords: Silicon Carbide, Composites, Modeling, Irradiation Effects

223. **DAMAGE ANALYSIS AND FUNDAMENTAL STUDIES FOR FUSION REACTOR MATERIALS DEVELOPMENT**
$225,000
DOE Contact: F. W. Wiffen, (301) 903-4963
UCSB Contacts: G. R. Odette, (805) 893-3525 and G. E. Lucas, (805) 893-4069

This research is directed at developing a fundamental understanding of both the basic damage process and microstructural evolution that take place in a material during neutron irradiation. This understanding is used with empirical data to develop physically-based models of irradiation effects. The focus is on the fracture properties of vanadium alloys, austenitic and ferritic stainless steels, including helium effects, to (a) develop an integrated approach to integrity assessment, (b) develop advanced methods of measuring fracture properties, and (c) analyze the degradation of the mechanical properties of austenitic stainless steels. The program contributes to the assessment of the feasibility of using these alloys in ITER and other fusion systems.

Keywords: Vanadium, Steels, Irradiation Effects, Fracture

224. **DEVELOPMENT OF LITHIUM-BEARING CERAMIC MATERIALS FOR TRITIUM BREEDING IN FUSION REACTORS**
$200,000
DOE Contact: S. Berk, (301) 903-4171
ANL Contact: C. Johnson, (708) 252-7533

Research activities are focused on critical issues of ceramic breeder blankets for fusion reactors, including ceramic breeder material tritium retention and release, ceramic breeder and beryllium irradiation response, chemical compatibility of ceramic breeder materials and beryllium with blanket coolant and structural materials, and heat transfer and temperature control in ceramic breeder materials. Small-scale laboratory experiments are performed to study tritium transport characteristics and to benchmark computer models of tritium transport. Computer models are tested against data on irradiation of lithium-oxide and lithium-zirconate materials in a fast-spectrum fission reactor. There is good agreement between model predictions and experimental data in the area of transient tritium release.

Keywords: Ceramics, Compatibility, Tritium Release, Modeling, Lithium Ceramics

225. **POST-IRRADIATION EXAMINATION OF LITHIUM-BEARING CERAMIC MATERIALS FOR TRITIUM BREEDING IN FUSION REACTORS**
$400,000
DOE Contact: S. Berk, (301) 903-4171
PNNL Contact: G. Hollenberg, (509) 376-5515

Research activities are for post-irradiation examinations (PIE) of the ceramic breeder materials irradiated in the Fast Flux Test Facility. The PIE is conducted as part of the BEATRIX-II program under an International Energy Agency agreement between the US, Japan, and Canada. PIE involves capsule disassembly, neutron radiography, plenum gas analysis, photography, mensuration characterization, tritium inventory measurements, microstructural characterization, and thermal conductivity measurements. PIE for specimens from the BEATRIX-II Phase 1 irradiation (lithium-oxide irradiated to 5 percent lithium atom burnup) and the Phase 2 irradition (lithium-oxide and lithium-zirconate irradiated to 5 percent lithium atom burnup) have been completed.

Keywords: Ceramics, Lithium Ceramics, Tritium Release

226. **INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER) MATERIALS DEVELOPMENT FOR PLASMA FACING COMPONENTS**
$5,500,000
DOE Contact: M. M. Cohen, (301) 903-4253
SNL Contact: M. Ulrickson, (505) 845-3020

Research activities include: improved techniques for joining beryllium to copper alloys, determination of the tritium retention of beryllium, improvement of the thermal conductivity of plasma sprayed beryllium, development of radiation damage resistant carbon-fiber composites, determination of erosion rates of beryllium, tungsten and carbon under normal and disruption conditions, and thermal fatigue testing of beryllium and carbon-fiber composites. The joining techniques being investigated include diffusion bonding, induction brazing, electroplating, and inertial welding. Tritium retention and permeation measurements have been conducted on the Tritium Plasma Experiment. The improvements in the plasma spray technique are centered on improving the beryllium powder and selection of the proper powder sizes. Highly oriented pitch based carbon fibers have been used to produce carbon-fiber composite for neutron irradiation. The erosion rates are measured on both plasma simulators and tokamaks. The thermal fatigue testing is carried out on electron beam test systems.

Keywords: Plasma-Facing Components, Beryllium, Carbon-Fiber Composite, Joining, Erosion, Thermal Fatigue

227. **ITER STRUCTURAL MATERIALS DEVELOPMENT**
$250,000
DOE Contact: F. W. Wiffen, (301) 903-4963
ANL Contact: D. L. Smith, (708) 252-4837

The ITER structural materials program is working toward the establishment of a database on the main candidate materials for use in the divertor, first wall, blanket and shield structures. The ANL program is evaluating candidate vanadium alloys. The early stages of this work are concentrating on baseline properties, irradiation effects, and compatibility with coolant fluids. Issues of fabrication, joining, and protective coatings are being incorporated as the program progresses.

Keywords: Vanadium, Irradiation Effects, Compatibility

228. **ITER CERAMIC MATERIALS**
$335,000
DOE Contact: F. W. Wiffen, (301) 903-4963
LANL Contact: E. H. Farnum, (505) 665-5223

The ITER will require ceramic materials in a number of the heating, current drive, and diagnostic elements of the plant. Behavior of these systems can be limited by their electrical, optical and/or structural properties. A program of in situ and post irradiation measurements to determine the effects of irradiation on these properties is conducted at LANL and other sites, with the goals of developing the properties database on candidate materials that will allow system designers to effectively include these components in the ITER plant.

Keywords: Ceramics, Electrical Properties, Optical Properties, Irradiation Effects

229. **RADIATION HARDENED FIBER OPTICS FOR ITER FUSION DIAGNOSTIC SYSTEMS**
$75,000
DOE Contact: F. W. Wiffen, (301) 903-4963
NRL Contact: D. L. Griscom, (202) 404-7087

This work evaluates the effects of fusion system irradiation on optical fibers and selects and/or develops fibers that are radiation resistant in use in diagnostic applications. Experiments on available fibers use gamma sources, spallation neutron sources, and fission reactors to characterize degradation of optical properties during and after irradiation. The most resistant fibers will be studied in more detail, and the data used to formulate potentially more resistant fiber compositions.

Keywords: Optical Fibers, Optical Properties, Irradiation Effects

230. **ITER MATERIALS EVALUATION**
$1,505,000
DOE Contact: F. W. Wiffen, (301) 903-4963
ORNL Contact: E. E. Bloom, (423) 574-5053 and A. F. Rowcliffe, (423) 574-5057

ITER requires structural materials and insulating ceramics for use in a range of system components exposed to the neutrons produced by the fusion reaction. ORNL's part of the ITER materials program is directed at the selection of promising compositions of austenitic stainless steels, copper alloys, and vanadium alloys and assisting in the development of the database needed for the use of these materials. Irradiation effects, compatibility and weldability of these materials are under study. The insulating ceramics work is focused on the electrical properties under irradiation, and the in situ measurement techniques to determine this response are being developed. The work at ORNL emphasizes the use of the HFIR to perform the irradiations in support of the ITER materials development and evaluation.

Keywords: Steels, Copper, Vanadium, Ceramics, Irradiation Effects, Electrical Properties

231. **ITER STRUCTURAL MATERIALS EVALUATION**
$490,000
DOE Contact: F. W. Wiffen, (301) 903-4963
PNNL Contact: R. H. Jones, (509) 376-4276

Materials systems of interest to ITER for use as structural materials in the divertor, first wall, and blankets are under evaluation to select the most attractive candidates in each system, and to develop the property database on these. The PNNL program is evaluating copper alloys, stainless steels, and vanadium alloys for the ITER program. While the emphasis is on irradiation effects, especially on fracture properties, the program at PNNL also is examining hydrogen effects and compatibility with water cooling.

Keywords: Steels, Copper, Vanadium, Irradiation Effects, Compatibility

232. **DEVELOPMENT OF Nb_3Sn SUPERCONDUCTING WIRE FOR THE ITER MAGNET PROGRAM**
$5,000,000
DOE Contact: M. M. Cohen, (301) 903-4253
MIT Contact: J. Minervini, (617) 253-5503

Activities include development of Nb_3Sn superconducting wire primarily for use in the high field magnets of the ITER model coils. Aggressive target specifications for high critical current density in the 12-13 tesla magnetic field range have been set and an industrial development program has begun to produce large quantities of this wire. U.S. superconducting wire industries involved include Intermagnetics General Corp./Advanced Superconductors Inc., and Teledyne Wah Chang Albany. Characterization of critical superconducting properties and ac losses has been carried out with measurements in university and national laboratories, including establishment of standardized samples and test procedures.

Keywords: Superconductors, Magnet Materials, Nb_3Sn

233. **STRUCTURAL MATERIALS DEVELOPMENT FOR THE CONDUIT OF ITER CABLE-IN-CONDUIT-CONDUCTORS**
$1,100,000
DOE Contact: M. M. Cohen, (301) 903-4253
MIT Contact: J. Minervini, (617) 253-5503

Activities include fabrication of conduit for the conductors of the central solenoid and toroidal field model coils for ITER. The conduit material, Incoloy alloy 908, was developed via collaboration of INCO Alloys International and MIT. Work is proceeding on development of the database for this material. Alloy 908 has a low coefficient of expansion and minimizes the compressive strain in the Nb_3Sn superconductor upon cool down from the heat treatment temperature of approximately 1000 K to the operation temperature of 4 K. Industrial processing by various methods to finished conduit shape has been a priority.

Keywords: Conduit, Incoloy, Magnet Materials

SMALL BUSINESS INNOVATION RESEARCH PROGRAM

The Small Business Innovation Research (SBIR) program is mandated by the Small Business Innovation Development Act of 1982 and the Small Business Research and Development Enhancement Act of 1992. The program is designed for implementation in a three-phase process, with Phase I determining, insofar as possible, the scientific or technical merit and feasibility of ideas proposed for investigation. The period of performance in this initial phase is about six months with awards up to $75,000. Phase II is the principal research or research and development effort and is performed in a period of up to two years with awards up to $750,000. Under Phase III, commercial applications of the research or research and development are to be pursued by small businesses with non-Federal capital or, alternatively, Phase III may involve follow-on non-SBIR Federal contracts for products or processes desired by the Government.

The materials-related projects, like all other projects in the DOE SBIR program, were selected using the specific evaluation criteria listed in the program solicitation. Award selection was based on detailed reports returned by reviewers drawn from DOE laboratories, universities, private industry, and government. In the Phase II technical evaluation process, an additional evaluation criterion addresses the commercial potential of the proposed scientific/technical work.

The work supported in this program represents high-risk research, but the potential benefits are also high if the objectives are met. Brief descriptions of all DOE SBIR projects (not just those of interest in materials research) are given in the following publications: Abstracts of Phase I Awards, 1995 (DOE/ER-0654), Abstracts of Phase II Awards, 1995 (DOE/ER-0655), and Abstracts of Phase II Awards, 1994 (DOE/ER-0628). Copies of these publications may be obtained by calling Mrs. Kay Etzler on (301) 903-5867.

MATERIALS PREPARATION, SYNTHESIS, DEPOSITION, GROWTH OR FORMING

PHASE I PROJECTS

Low Cost, Contamination-Tolerant Electrocatalysts for Low-Temperature Fuel Cells - DOE Contact Cynthia Carter, (301) 903-5997; Aspen Systems, Inc. Contact Dr. Kang P. Lee, (508) 481-5058

Laser Consolidation of Silicon Carbide/Titanium Metal Composite Turbine Rings - DOE Contact Cynthia Carter, (301) 5997; Cordec Corporation Contact Mrs. Helen Pierides, (703) 550-8044

Solid Free-Body Formed Alumina-Tungsten Electrode Insulators for Heavy Ion Fusion Accelerators - DOE Contact Mark A. Wilson, (301) 903-5048; Advanced Ceramics Research, Inc. Contact Mr. Mark Angier, (602) 792-2616

High Current Density High Temperature Superconductor Composite Conductors - DOE Contact James Daley, (202) 586-1165; American Superconductor Corporation Contact Mr. Ramesh Ratan, (508) 836-4200

Superconducting Wires for Alternating Current Magnet Applications - DOE Contact James Daley, (202) 586-1165; American Superconductor Corporation Contact Mr. Ramesh Ratan, (508) 836-4200

A Low Cost, High Temperature Superconductor Wire Manufacturing Technology - DOE Contact James Daley, (202) 586-1165; American Superconductor Corporation Contact Mr. Ramesh Ratan, (508) 836-4200

A Low Cost Receiver Plate Manfacturing Process for High Concentration Photovoltaic Systems - DOE Contact Alec Bulawka, (202) 586-5633; Amonix, Inc. Contact Mr. Vahan Garboushian, (310) 325-8091

Gallium Phosphide Ultraviolet Diode Arrays - DOE Contact Michael O'Connell, (202) 586-9311; AstroPower, Inc. Contact Mr. Thomas J. Stiner, (302) 366-0400

An Intumescent Mat Material for Joining of Ceramics to Metals at High Temperatures - DOE Contact William J. Gwilliam, (304) 285-4401; CeraMem Corporation Contact Dr. Robert L. Goldsmith, (617) 899-0467

A New Alloy for Refiner Plates in the Pulp and Paper Industry - DOE Contact Charles Sorrell, (202) 586-1514; Climax Research Services Contact Mr. James R. Lakin, (810) 489-0720

Development of Modulator Quality Rubidium Titanyl Arsenate Crystals for Remote Sensing Laser Systems - DOE Contact Michael O'Connell, (202) 586-9311; Crystal Associates, Inc. Contact Mr. G. M. Loiacono, (201) 612-0060

Slicing of Silicon Ingots with Reduced Kerf - DOE Contact Alec Bulawka, (202) 586-5633; Crystal Systems, Inc. Contact Dr. Chandra P. Khattak, (508) 745-0088

A Novel Method to Recycle Thin Film Semiconductor Materials - DOE Contact Alec Bulawka, (202) 586-5633; Drinkard Metalox, Inc. Contact Mr. Fred Gallagher, (704) 332-8173

Development of Novel Iron-Chromium-Silicon Alloys for Use in Kraft Recovery Boilers - DOE Contact Charles Sorrell, (202) 586-1514; E. R. Johnson Associates, Inc. Contact Mr. L.H. Donaldson, (703) 359-9355

High Capacity Carbon Anodes for Lithium Ion Batteries - DOE Contact Robert Marianelli, (301) 903-5808; EIC Laboratories, Inc. Contact Dr. A. C. Makrides, (617) 769-9450

Refractory Coatings for Improved Papermaking - DOE Contact Charles Sorrell, (202) 586-1514; Eltron Research, Inc. Contact Ms. Eileen E. Sammells, (303) 440-8008

An Improved Material and Low-Cost Fabrication Options for Candle Filters - DOE Contact William J. Gwilliam, (304) 285-4401; FluiDyne Engineering Corporation Contact Dr. Gary J. Hanus, (612) 544-2721

An Integrated Catalyst/Collector Structure for Regenerative Proton-Exchange Membrane Fuel Cells - DOE Contact Cynthia Carter, (301) 903-5997; Giner, Inc. Contact Dr. Anthony B. LaConti, (617) 899-7270

Pseudo-Porous Zirconium Carbide Fiber Coating for Environmentally Durable Silicon Carbide/Silicon Carbide Composites - DOE Contact Helen Kerch, (301) 903-2346; Hyper-Therm High-Temperature Composites, Inc. Contact Mr. Wayne S. Steffer, (714) 375-4085

A Resistive Fault Current Limiter Based on Highly Directional Superconductor Thick Film Conductors - DOE Contact James Daley, (202) 586-1165; Illinois Superconductor Corporation Contact Ms. Ora Smith, (708) 391-9400

A Low Cost, Windable Yttrium-Barium-Copper-Oxide Conductor by Continuous Ion Beam Assisted Deposition/ Metal Organic Chemical Vapor Deposition on a Metallic Substrate Tape - DOE Contact James Daley, (202) 586-1165; Intermagnetics General Corporation Contact Mr. Carl H. Rosner, (518) 782-1122

In-Situ Removal and Recycling of Copper Indium Selenide from Thin-Film Solar Cells - DOE Contact Alec Bulawka, (202) 586-5633; Interphases Research Contact Mr. Leslie Affonso, (805) 492-9814

Conformal Source Ion Implantation - DOE Contact Cynthia Carter, (301) 903-5997; ISM Technologies, Inc. Contact Mr. Robert J. Stinner, (619) 530-2332